II. REMARKS

A. Introductory Remarks

Reconsideration and allowance of this application is requested. Claims 8-19 are pending in this application. Claims 1-7 were previously canceled. Applicants, however, reserve the right to file a continuation or divisional application on the subject matter of any of the canceled claims.

B. Negative Limitations Are Not Indefinite

The Examiner has rejected the claims under 35 U.S.C. 112, second paragraph, due to the negative limitation in claims 8 and 14, citing a half-century old case that is not considered current law by authorities, such as the MPEP. *See*, MPEP 2173.05(i).

> The current view of the courts is that there is nothing inherently ambiguous or uncertain about a negative limitation. So long as the boundaries of the patent protection sought are set forth definitely, albeit negatively, the claim complies with the requirements of 35 U.S.C. 112, second paragraph. Some older cases were critical of negative limitations because they tended to define the invention in terms of what it was not, rather than pointing out the invention. Thus, the court observed that the limitation "R is an alkenyl radical other than 2-butenyl and 2,4-pentadienyl" was a negative limitation that rendered the claim indefinite because it was an attempt to claim the invention by excluding what the inventors did not invent rather than distinctly and particularly pointing out what they did invent. *In re Schechter*, 205 F.2d 185, 98 USPQ 144 (CCPA 1953).
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> A claim which recited the limitation "said homopolymer being free from the proteins, soaps, resins, and sugars present in natural Hevea rubber" in order to exclude the characteristics of the prior art product, was considered definite because each recited limitation was definite. *In re Wakefield*, 422 F.2d 897, 899, 904, 164 USPQ 636, 638, 641 (CCPA 1970). In addition, the court found that the negative limitation "incapable of forming a dye with said oxidized developing agent" was definite because the boundaries of the patent protection sought were clear. *In re Barr*, 444 F.2d 588, 170 USPQ 330 (CCPA 1971).
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> Any negative limitation or exclusionary proviso must have basis in the original disclosure. If alternative elements are positively recited in the specification, they may be explicitly excluded in the claims. See *In re Johnson*, 558 F.2d 1008, 1019, 194 USPQ 187, 196 (CCPA 1977) ("[the] specification, having described the whole, necessarily described the part remaining."). See also *Ex parte Grasselli*, 231 USPQ 393 (Bd. App. 1983), *aff'd mem.*, 738 F.2d 453 (Fed. Cir. 1984).

As with the more recent cases, such as *In re Barr*, *Ex parte Grasselli*, *In re Johnson*, and the like, the present limitation specifying that the compositions claimed in the present invention do not have abrasives is very pertinent because the prior art cited are to CMP compositions, which contain abrasives as a necessary element. There is nothing unclear to one of skill in the art when one uses the term "abrasives." The first paragraph in Wikipedia states:

"An abrasive is a material, often a mineral, that is used to shape or finish (see metal polishing and wood finishing) a workpiece through rubbing which leads to part of the workpiece being worn away. While finishing a material often means polishing it to gain a smooth, reflective surface it can also involve roughening as in satin, matte or beaded finishes."

There is no emphasis added and no embellishment, the entry itself specifically associates abrasives with use in polishing a workpiece, which is exactly the purpose of abrasives in a CMP application. One skilled in the art would have no doubt as to the meaning, that the composition does not contain "abrasives."

The Examiner also claims it is unclear "if the removal step comprises the addition of abrasives…", presumedly suggesting consisting essentially of language. This rejection was not entirely clear in that there appears to be no basis to apply this argument to claims 8-13. The language of claim 8 expressly states: "for a time and at a temperature sufficient to cause the composition to remove…." That was the only removal step of claim 8 and the claim specifies that the composition does not include any abrasives and that the composition removes "at least a portion of the TiW alloy and substantially all of the etching residue from the substrate." Thus, it appears clear that the invention, as claimed in claims 8-13, expressly specified that an abrasive free composition removed the TiW and etching residue. Applicant requests that the Examiner reconsider this rejection of claims 8-13.

Regarding claims 14-19, although it is also clear that an abrasive free composition is used to remove the etching residue in claim 14 and that one skilled in the art would understand the solution used to remove TiW is also abrasive free, Applicants have modified the wording of claim 14 in a way that the claims are synonymous and exactly the same scope as before but perhaps more preferred to the Examiner. The support for this amendment is the same as for "does not include abrasives" done previously, and from which the Examiner has accepted.

Frankly, if ever such an argument was found to be a proper basis for rejection – namely, that in a "comprising" method claim an unclaimed composition could responsible for the success of the method – then there would be little point in using the term "comprising." Such historical

theory need not be resorted to with the present language, as it clearly claims that the abrasive free compositions and solutions are doing the removing.

C. The Cited Prior Art Are Abrasive Containing Slurries

The Examiner continues to reject claims 8-19 as obvious over U.S. 5,858,813 ("Scherber") and U.S. 6,569,349 ("Wang").

1. Scherber

Scherber teaches a polishing slurry for chemically mechanically polishing (CMP) metal layers and films during the various stages of multilevel interconnect fabrication. See abstract. Scherber's slurry includes an aqueous medium, an abrasive, an oxidizing agent, and an organic acid. See abstract and col. 2, lines 33-36. As cited in the Office Action, Scherber discloses that the suitable oxidizing agents include periodic acids (0.5 to 15% by weight). See col. 5 lines 7-13. Further, as cited in the Office Action, Scherber discloses that chemical mechanical polishing involves 'concurrent' chemical and mechanical polishing of an overlaying first layer to expose the surface of a non-planar second layer on which the first layer is formed. See col. 1, lines 34-38. Additionally, Scherber teaches his polishing slurry may be used to provide controlled polishing selectivities to thin-film materials such as titanium, titanium nitride, titanium tungsten and similar alloys. See col. 10 lines 14-20. Thus, from the foregoing disclosure in Scherber, it is quite clear to one skilled in the art that Scherber is concerned with and directed to improved method of using chemical mechanical polishing slurries for polishing metal layers and thin-films used in semiconductor integrated circuit manufacturing. See col. 1, lines 8-11. [emphasis added].

2. Wang

Similarly, Wang is directed to a slurry composition for chemical mechanical polishing and planarization (CMP). See abstract. Wang teaches a polishing slurry composition that comprises oxidizers, chelating agents, surfactants, polar solvent, corrosion inhibitors, and may include an abrasive. See col. 2 lines 15-21. As cited in the Office Action Wang teaches polishing and planarizing TiW substrate. See col. 6 lines 42-49. Further, as cited in the office action, Wang teaches using a first polishing composition in the CMP process to remove at least a

portion of the copper layer **313** with high selectivity to TaN barrier layer **312** to stop thereon. A second CMP composition and CMP process is used for planarizing TaN and the underlying barrier layer to remove the TaN barrier layer and to reduce scratching defects formed on the dielectric layer on the substrate surface thereby completing planarization. See col. 8, lines 9- 25. Thus, from the foregoing discussion it is clear to one skilled in the art that Wang is concerned and directed to a chemical mechanical planarization (CMP) composition and a method to planaraize a substrate comprising a metal layer and a barrier layer over a dielectric layer.

As stated by the Federal Circuit, "a proper analysis under 35 U.S.C. §103 requires, *inter alia*, consideration of two factors:(1) whether the prior art would have suggested to those of ordinary skill in the art that they should make the claimed composition or device, or carry out the claimed process; and (2) whether the prior art would also have revealed that in so making or carrying out, those of ordinary skill would have a reasonable expectation of success." *In re Vaeck*, 947 F. 2d 488, 493 (Fed. Cir. 1991). In addition, the prior art references must teach or suggest all the claim limitations. The teaching or suggestion to combine and the reasonable expectation of success must be found in the prior art, and not in the applicants' disclosure. *Id.* at 493. See, also MPEP §2142. Further, the Federal Circuit recently held "[t]he best defense against the subtle but powerful attraction of hindsight-based obviousness is rigorous application of the requirement for a showing of the teaching or motivation to combine prior art references." (*In re Lee*, 61 U.S.P.Q.2d 1430, 1433 (Fed. Cir. 2002), quoting from *In re Dembiczak*, 50 U.S.P.Q. 2d 1614, 1617 (Fed Cir. 1999)). Applicants respectfully submit that the references of Scherber and Wang cited in the Office Action fail to meet the tests prescribed by the Federal Circuit as discussed below.

Both Scherber and Wang, however, are to abrasive containing slurries and both teach away from using non-slurries in their inventions. Scherber discloses in the first lines of the Summary of Invention that: "The present invention is directed to a chemical mechanical polishing slurry for polishing metal layers and thin-films. The polishing slurry includes an aqueous medium, an abrasive, an oxidizing agent, and organic acid." There is not a single slurry disclosed in Scherber that does not contain an abrasive. That is because Scherber is to CMP compositions. As Scherber describes: "In general, CMP involves the concurrent chemical and mechanical polishing of an overlying first layer to expose the surface of a non-planar second

layer on which the first layer is formed." *See*, col. 1, lines 35-37. Although there are CMP formulations that do not have abrasives, the compositions of Scherber all have abrasives, including the sections referred to by the Examiner.

The Examiner relies upon the following language in Scherber to offer support for the rejection:

"In addition, the polishing slurry of the present invention has been found to significantly lower or inhibit the silicon dioxide polishing rate, thus yielding enhanced selectivity with respect to the dielectric layer. Furthermore, the polishing slurry may be effectively used to provide controlled polishing selectivities to other thin-film materials used in current integrated circuit technology, such as copper and titanium, as well as underlayers such as titanium, titanium nitride, titanium tungsten and similar alloys." col. 10, lines 15-20.

That language specifically relates to a slurry, not a solution or a composition that does not contain an abrasive. Slurries are commonly understood as containing both liquid and particle portions and in CMP compositions, the particle portion is almost exclusively an abrasive. Again, Wikipedia states that a slurry is "a thick suspension of solids in a liquid and may be:…

- An abrasive substance used in chemical-mechanical polishing, a semiconductor manufacturing process…."

The present claims have been amended to clarify that the etch residue removal and TiW etching are by compositions and solutions that do not include the optional abrasive component disclosed in paragraph 68 of the specification.

As previously argued, Scherber never discloses removing an etching residue, which the Examiner states is inherent but that is not the case. For etching residue, etching must occur and etching is typically not performed prior to planarization, which is when a CMP composition is used. There is nothing in Scherber that states the slurries can be modified by taking out the abrasive and used to remove etching residue. Simlarly, Wang is to a method and composition for *planarizing* a substrate, not for removing an etching residue using a composition containing periodic acid. In contrast to the planarization of Scherber and Wang, claims 8 and 14 are to etch metal and remove etching residue. As one of skill in the art fully knows and appreciates, planarization methods are very different from removing etching residues. The former removes

excess material that had been deposited on a surface to "planarize" – or flatten -- the surface. The latter removes residues that result from etching a substrate, not planarization.

Another citation by the Examiner further supports the differences. Col. 1, Lines 35-37 of Scherber, cited previously in support of the differences of the claimed invention and cited prior art, describes that CMP slurries are used in a chemical and mechanical polishing of an overlying first layer to expose the surface of a non-planar second layer on which the first layer is formed. There is no statement of a previous etching step (or a subsequent one) or a chemical etching step.

The Examiner also cites column 6, lines 40-43 to allege that the polishing slurry need not contain abrasives but that is not what is stated in column 6. Column 6 requires that the two or multi package systems be "added to the slurry just prior to polishing." Meaning, there is no "polishing slurry of the present invention" that does not include an abrasive. If anything, this citation again shows that an abrasive is required to be considered a polishing slurry of Scherber. Even when the components are stored seperately ("when an oxidizing agent decomposes or hydrolyzes over time" – not Periodic Acid, which is considered "Stable under ordinary conditions" http://chemicalland21.com/industrialchem/inorganic/PERIODIC%20ACID.htm). This is a particularly inapplicable argument where the present claims are method claims for obvious reasons.

Wang, similarly, is to abrasive containing CMP compositions and methods. Again, there is nothing in Wang – nor any part of Wang cited by the Examiner – that the slurries of the invention can be abrasive-free.

Applicants submit that even if there was suggestion or motivation to combine Scherber and Wang – which as discussed there is not– the combination does not teach all the limitations of the invention of claims 8 and 14. Scherber does not teach or suggest the limitations of etching the exposed TiW alloy and removing the TiW etch residue using an abrasive-free composition of periodic acid or hydrogen peroxide. As discussed above, Scherber discloses a CMP process and does not solve the problem of etching or cleaning a TiW alloy. Similarly, Wang teaches a two-step CMP process involving exposing the substrate in the first step by polishing method and removing the exposed substrate in the second step also by a polishing method – both steps using

an abrasive. Wang does not even teach periodic acid as an oxidizer. There is no way to combine these references to render the invention of claims 8-19 obvious.

C. Conclusion

Since Scherber teaches away from using abrasive-free compositions, it is improper to combine Scherber with Wang. All the slurries in Scherber and Wang teach the use of abrasives. Both Scherber and Wang are to a totally different method and process using different chemistries than claims 8-19. Accordingly, Applicants request reconsideration of the claims and allowance of claims 8 and 14.

No fees are believed to be due. However, if any additional fees are determined to be due, the Commissioner is hereby authorized to charge these fees to the Morgan, Lewis & Bockius Deposit Account no. 50-0310.

Respectfully submitted,

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